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Engine Wear Test (Oil Analysis): Toyota Yaris 2015

The Yaris is a 1.3 L 5 door hatch with 10,000 km oil change intervals. The engine was run in for 10,000 km before testing was started and treated once with Xcelplus at 20,000 km.

Summary

Wear in the engine was reduced significantly at 50,000 km:

-82 % Iron

-57 % Aluminium

-91 % Copper

Table 1 Reduction in wear

| Metal | Reduction (ppm) |
|--------------------|-----------------|
| Iron (Fe) | -18 (-82 %) |
| Aluminium (Al) | -4 (-57 %) |
| Copper (Cu) | -10 (-91 %) |
| Chromium (Cr) | n/a |
| Tin (Sn) | -2 (-100 %) |
| Nickel (Ni) | -2 (-100 %) |
| Lead (Pb) | -1 (-100 %) |
| Viscosity @ 100 °C | +1.9 (+13 %) |
| Viscosity @ 40 °C | +22 (+20 %) |

Table 2 Oil and filter changes

| Mileage | Comments |
|-----------|---|
| 10,332 km | Oil change |
| 20,607 km | First oil sample taken (Xcelplus added) |
| 30,622 km | Second oil sample taken |
| 40,988 km | Third oil sample taken |
| 50,865 km | Fourth oil sample taken |

N.B. Raised silicon (dirt) levels correspond to driving on dirt roads in the country: The air filter was changed three times to ensure the problem was not a faulty filter. The Viscosity Variance Report showed significantly improved oil quality.



Figure 1 Yaris 2015 white 1.3 L 5 door hatch



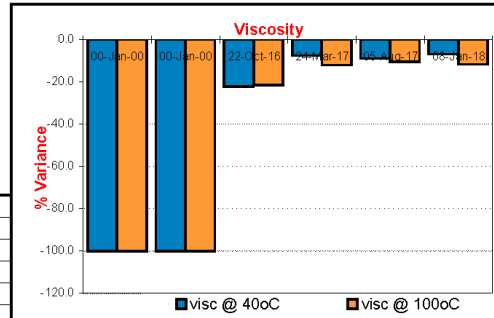
CONDITION MONITORING



TECHNICAL ADVANCE FOR ECONOMIC GAIN

WATCH

Wear Metal Report: 356,546
Client: MICHAEL CZAJKA
Attention:
Machine: TOYOTA YARIS **ID No:** 1FD1FN
Oil Name: SYNTECH SEMI SYN15W50
Visc@40°C: 144 **Visc@100°C:** 19 **TBN:** 0
Compartment: TOYOTA YARIS



| Sample Date | 0/01/1900 | 0/01/1900 | 22/10/2016 | 24/03/2017 | 5/08/2017 | 8/01/2018 |
|---------------|-----------|-----------|------------|------------|-----------|------------|
| Analysis Date | 0/01/1900 | 0/01/1900 | 1/11/2016 | 29/03/2017 | 8/09/2017 | 12/01/2018 |
| Sample no. | 0 | 0 | 343502 | 347771 | 352928 | 356546 |
| SMU | 0 | 0 | 20607hrs | 30622hrs | 40988hrs | 50865hrs |
| Oil Hrs | 0 | 0 | 0 | 10,015 | 10,366 | 9,877 |
| Oil Changed | 0 | 0 | Yes | Yes | Yes | Yes |

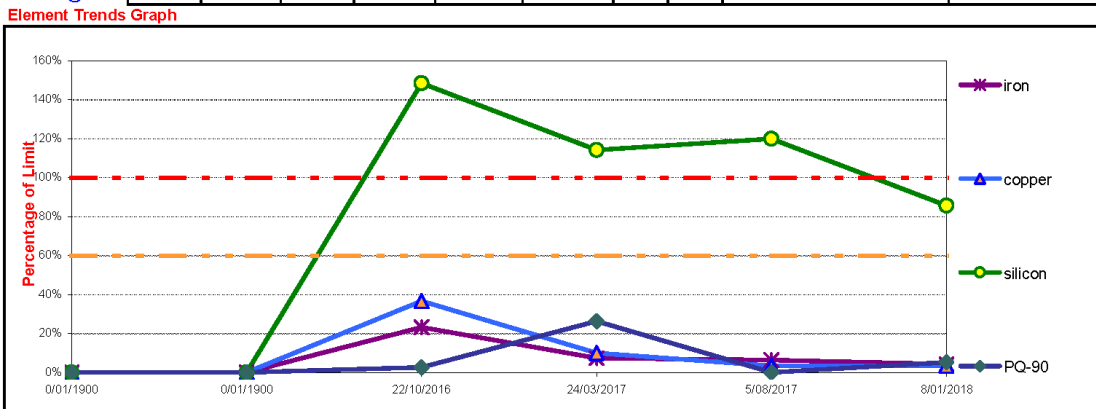
| Wear Metals | ppm | ppm | ppm | ppm | ppm | ppm | Caut | High | Comments on elevated results |
|-------------|-----|-----|-----|-----|-----|-----|------|------|--|
| lead | 0 | 0 | 1 | 0 | 0 | 0 | 60 | 80 | Silicon is elevated at 30ppm. Silicon is a highly abrasive material and can cause accelerated wear. Check air intake system. |
| iron | 0 | 0 | 22 | 7 | 6 | 4 | 75 | 95 | |
| aluminium | 0 | 0 | 7 | 4 | 4 | 3 | 10 | 16 | |
| copper | 0 | 0 | 11 | 3 | 1 | 1 | 20 | 30 | |
| chromium | 0 | 0 | 0 | 0 | 1 | 0 | 10 | 15 | |
| tin | 0 | 0 | 2 | 0 | 1 | 0 | 10 | 15 | |
| nickel | 0 | 0 | 2 | 0 | 0 | 0 | 10 | 15 | |

| Contaminants | ppm | ppm | ppm | ppm | ppm | ppm | Caut | High |
|--------------|-----|-----|-----|-----|-----|-----|------|------|
| silicon | 0 | 0 | 52 | 40 | 42 | 30 | 20 | 35 |
| sodium | 0 | 0 | 4 | 5 | 4 | 3 | 20 | 30 |

| Oil Additives | ppm | ppm | ppm | ppm | ppm | ppm | Caut | High |
|---------------|-----|-----|------|------|------|------|------|------|
| magnesium | 0 | 0 | 3 | 2 | 2 | 1 | 0 | 0 |
| zinc | 0 | 0 | 954 | 749 | 702 | 578 | 0 | 0 |
| molybdenum | 0 | 0 | 6 | 4 | 1 | 0 | 0 | 0 |
| calcium | 0 | 0 | 1767 | 1732 | 1731 | 1519 | 0 | 0 |
| phosphorous | 0 | 0 | 0 | 620 | 629 | 554 | 0 | 0 |
| boron | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |

| Infra Red | ppm | ppm | ppm | ppm | ppm | ppm | Caut | High |
|----------------|------|------|------|------|------|------|------|------|
| TBN | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -25% | -50% |
| soot | 0 | 0 | 1 | 3 | 0 | 0 | 50 | 70 |
| glycol% | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| water (ppm) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1 | 2 |
| fuel dilution% | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 |
| oxidation | 0 | 0 | 15 | 14 | 17 | 16 | 30 | 40 |
| nitration | 0 | 0 | 11 | 10 | 11 | 22 | 30 | 40 |
| sulphation | 0 | 0 | 20 | 19 | 24 | 23 | 30 | 40 |
| TAN | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0 | 0 |

| Physical Tests | ppm | ppm | ppm | ppm | ppm | ppm | Caut | High | Particle Cleanliness Analysis - ISO CODE 4406 |
|----------------|------|------|--------|--------|--------|--------|------|------|---|
| water % | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 µm - |
| PQ-90 mg / ltr | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 38 | 6 µm - |
| visc @ 100oC | 0.00 | 0.00 | 14.90 | 16.70 | 17.00 | 16.76 | +10% | +30% | 14 µm - |
| visc @ 40oC | 0.00 | 0.00 | 112.00 | 133.00 | 131.00 | 134.00 | +10% | +30% | SAE AS 4059 NAS CODE 0 |



For enquiries, contact: phone: fax: mobile:

This wear analysis and oil condition report should be used in conjunction with normal maintenance and evaluated from sample to sample. Every care will be taken in processing samples but no express or implied guarantee is furnished in regard to the continuing operation or condition of this machinery or any part thereof.